DUCTILE IRON PIPE AND FITTINGS

ITEM 1000

WORK INCLUDED: (Sec. 01) Furnish, install, connect, test and if required, sterilize all cast and/or ductile iron pipe, fittings and wall castings, including joint materials, coatings and linings as shown on the Drawings and specified herein.

Earth excavation, backfill and bedding for buried pipe are included in this Item.

The following, if required, shall be furnished and paid for in their respective Items.

Rock Excavation
Granular Backfill
Concrete

REFERENCE ITEMS: (Sec. 02) Work and/or materials to be performed and/or furnished in accordance with other Items but included for payment in this Item are:

Earth Excavation and Backfill
Sheeting and Timbering, Left in Place
Testing of Pipelines and Sewers
Sterilization of Potable Water Lines and Tanks

Applicable portions of the latest revision of the following specifications shall be included as a part of this Specification.

ANSI - American National Standards Institute
ASTM - American Society for Testing and Materials
AWWA - American Water Works Association
ODOT - Ohio Department of Transportation, Construction and Materials Specifications

DESCRIPTION: (Sec. 03) This Item includes all cast and ductile iron pipe, fittings and wall castings, according to the designations listed below, together with joints and jointing materials, inside and outside protective coatings, couplings, expansion joints, drilling and tapping, testing and sterilization.

Fittings are defined as any straight pipe three feet or less in length, bends, tees, laterals, filler pieces, reducers, reducing bends, etc., with or without bases, of whatever shape or dimensions, and any pipe of whatever length having two bells.

Wall castings are defined as any special pipe as listed in the wall casting schedule, or marked as a wall casting on the Drawings.

Yard piping is that pipe requiring excavation and terminating at the outside face of structure walls or at the bottom of floor slabs. Piping (structures) is that pipe requiring no excavation.

DESIGNATION: (Sec. 04) The following designations correspond to the numbers stipulated in the proposal and indicate the materials required:

ITEM	UNIT	DESCRIPTION
1000	L.F.	Ductile Iron Pipe, includes pipe and fittings (Distribution Systems an Force Mains)
1001	L.F.	Ductile Iron Pipe, Cement Lined, includes pipe and fittings (Distribution Systems)
1002	Ton	Ductile Iron Pipe, M.J., includes pipe only (Yard Piping)
1003	Ton	Ductile Iron Pipe, M.J., includes pipe only (Structures)
1004	Ton	Cast or Ductile Iron Pipe Fittings, M.J., (Yard and Structures)
1005	Ton	Ductile Iron Pipe, Flanged
1006	Ton	Cast or Ductile Iron Pipe Fittings, Flanged
1007	Ton	Ductile Iron Pipe, Glass Lined, includes fittings, (Yard)
1008	Ton	Ductile Iron Pipe, Glass Lined, includes fittings (Structures)
1009	Ton	Cast Iron Wall Castings

PIPE AND FITTINGS: (Sec. 05) Pipe and fittings shall comply with the following standards unless specified otherwise:

Ductile iron pipe, AWWA C151. Class as indicated on the drawings.

Rubber gasket joints for pipe with bell and spigot, push-on, or mechanical joints for all pressure classes, AWWA C111.

Flanged pipe, with threaded flanges AWWA C115.

Flange facing and drilling, ANSI B16.1 for 125 lb. rating and B16.2 for 250 lb. rating.

Fittings for all types of joints and 125 lb. and 250 lb. pressure ratings, AWWA C110.

Joint materials, AWWA C111.

River crossing pipe, AWWA C151 class as shown on the drawings, with pipe, bell and gland made of ductile iron. Bolts and gaskets, AWWA C111.

Locked mechanical joint pipe shall be rated for 250 psi water working pressure with wall thickness added to compensate for the locking ring groove.

PROTECTIVE COATINGS AND LININGS: (Sec. .06) Coat the outside of all pipe and fittings and the inside of all pipe and fittings which are not cement lined with a coal-tar or asphalt base bituminous coating per AWWA C151. Clean castings of rust and foreign matter before coating. Wall castings to be inserted in concrete walls may be either uncoated or coated on their exterior; uncoated exteriors are preferred, but are not mandatory.

Interior piping which is to be painted may be furnished with a prime coat of Tnemec 77 Chem Primer, Koppers Pug Primer or equal in lieu of coal-tar coating.

Where shown on the Drawings, install cast iron pipe with an 8 mil polyethylene encasement, AWWA C105.

Cement Lining: Cement line all pipe and fittings used for potable water distribution systems in strict conformity with AWWA C104 standard specifications for Cement-Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings for Water, standard thickness, unless otherwise specified. Apply bituminous seal coat inside after the lining has cured.

Furnish with each shipment of cement mortar lined pipe two copies of a certification that all cement lining meets the requirements of AWWA C104.

Cement lining shall not be used for force mains or lines located in water or wastewater treatment plants, or lift stations, unless specifically noted on the Drawings.

Glass Lined Pipe: Where specified or shown on the Drawings, line the inside of pipe with SG-14, as manufactured by the Permutit Company, Paramus, NJ, SL-31 as manufactured by Ceramic Coating Company, Newport, KY, or equal, with a thickness of .008" - .012", a hardness of 400 on the Knoop scale or five to six on the Mohs scale, and a density of 2.5 to 3.0 grams per cubic centimeter.

Hold field cutting to an absolute minimum. Spalling shall not occur more than one-eight inch from the cut, with no fish-scaling or crazing beyond this point. Follow the recommendations of the manufacturer when cutting pipe.

Inspect each fitting or piece of pipe before installing to insure that there are no defects in the lining. Any piece having a break in the lining shall be rejected.

Polypropylene Lining: Where shown on the Drawings furnish ductile iron pipe with polypropylene lining. Use only virgin polypropylene with the following physical properties:

Tensile Strength	4500-5200 psi
Elongation	200%
Specific Gravity	0.90 - 0.92

Minimum liner wall thickness shall be as follows:

1" and 1 1/2" pipe	.150"
2" and 3" pipe	.175"
4" pipe	.210"
6" pipe	.240"
8" and 10" pipe	.285"

Provide flange sealing surfaces and 1/16" vent holes as recommended by the lining manufacturer. Face plates must remain in place during storage and handling; remove only for installation. Follow manufacturer recommendations for handling and installing.

HANDLING AND INSTALLATION: (Sec. 07) Use suitable tools and equipment for the safe and convenient handling and laying of the pipe and fittings as described in the pamphlet "Guides for Installation of Ductile Iron Pipe and Gray Cast Iron Water Mains", published by the Ductile Iron Pipe

Research Association. Unload pipe, fittings and accessories from cars or trucks with hoists or by skidding.

Under no circumstances shall pipe be dropped. Do not skid nor roll against pipe already on the ground. Castings and lining must not be damaged; but, should slight damage occur to linings, repairs may be made at the site to the satisfaction of the Resident Representative.

Just prior to installing any pipe or fittings, it shall be subject to inspection and approval by the Resident Representative. Use no broken, cracked, imperfectly coated, unsatisfactory or damaged pipe. Contractor is fully responsible for the material installed.

Thoroughly clean all pipe and fittings before they are installed and keep clean until the work is completed.

All pipe in buildings, tunnels and tanks shall be properly supported by cast iron, malleable iron, wrought iron or steel brackets or hangers, or by concrete piers, as shown on the Drawings, specified or as required.

Lay buried pipe on bedding material. Use adequate means to prevent settlement. Bedding shall be gravel, crushed limestone or slag, No. 6, 67 or 68 gradation, per Table 703-1 of the ODOT Specifications, free from dirt and other deleterious materials, well tamped and laid on undisturbed earth or well tamped backfill. Uniformly support pipe throughout except bell holes are required for proper installation of the joints. Use no slag for bedding or backfill. Lay no pipe or fitting within six inches of solid rock or a boulder.

When the pipes (new or existing) require cutting to fit in the lines, cut at right angles to the axis of the pipe leaving a smooth cut. No measurement will be made for the portion cut off if not installed.

Wall Casting Option: In lieu of wall castings the Contractor may, if approved by the Engineer, provide and install modular mechanical type sealing assemblies. Seal assembly shall provide a watertight seal between the pipe and the sleeve and shall include a steel sleeve and seals of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the sleeve. Sleeves shall be provided with water stops at the center of the wall. Provide corrosion protected carbon steel bolts, nuts and pressure plates. Each assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved.

JOINTS : (Sec. 08) Joints shall be as indicated on the Drawings.

Mechanical Joints; Join all mechanical joint pipe and fittings using rubber or neoprene gaskets and cast iron (ASRM A-48) follower glands. Use tee head bolts and hex nuts of corten steel alloyed with copper (0.5%), nickel (0.5%) and chromium (1%).

Clean the inside of the bell and the outside of the spigot by wire brushing just before making the joint to remove rust and foreign material. Bring the follower gland toward the pipe flange evenly. Tighten joint bolts with approved wrenches to the tension recommended by the pipe manufacturer.

Whenever connections are made between cast iron mechanical joint pipe or fittings and pipe or fittings of other material, use an approved type of transition gasket in the mechanical joint.

Push-On Joints: Join pipe with push-on joints with a rubber ring gasket inserted in the bell end. All rubber gaskets shall bear the identifying mark of the manufacturer, gasket size, and the year of manufacture. Rubber shall be all new natural or synthetic having the mechanical properties required for the service.

Clean the inside of the bell and the outside of the spigot by wire brushing just before making the joint. Use lubricant recommended by the pipe manufacturer.

Flanged Joints: Align connecting flanges so that no external force is required to bring them together. Use gaskets, bolts or studs, and nuts meeting the following specifications:

Bolts: ASTM A-307, Grade B with ANSI B18.2 Hexagon heads, ASNI B1.1 coarse thread series, Class 2A fit.

Studs: ASTM A-108, ANSI B1.1 coarse thread series, Class 2A fit.
All studs and nuts used in wall castings, either flanged or mechanical joint in contract with a liquid, or underground shall be 304 stainless steel.

Nuts: ASTM A-307 ANSI B18.2 heavy hexagon dimension, ANSI B1.1 coarse thread series, Class 2B fit.

Cadmium plate bolts and nuts after the threads are cut. Cadmium plating, shall have a thickness of 0.0003 to .0005 inch.

Gaskets: Use full face or ring type red rubber gaskets, one sixteenth inch thick in all flanged joints, except that one-eighth inch thick gaskets may be used in runs of pipe over 30 feet in length.

Grooved Joints: Use grooved joints where shown on the Drawings. Pipe Joints shall be flexible unless noted as rigid, Victaulic Style 31, Gruvajoint by Aeroquip or equal.

Bell and Spigot Joints Bell and spigot joints will not be permitted unless shown on the Drawings or required to make connections to existing piping.

COUPLING: (Sec. 09) Couplings buried in the ground or submerged in water, sewage or sludge shall be Dresser Style 53, Rockwell 431 or equal; couplings installed on pipe exposed in buildings or above ground shall be Dresser Style 38, Rockwell 411 or equal, for cast iron pipe; Dresser Style 62, Rockwell 415, or equal shall be used to join cast iron and steel pipe.

Middle rings of the couplings shall have a length of not less than seven inches, and a thickness of six inch to twelve inch pipe of not less than one-quarter inch, and for pipe fourteen inches in diameter and over, not less than five-sixteenths of an inch.

After the installation of couplings that will be furied or submerged, paint the entire coupling, including all nuts and bolts, with two coats of coal tar enamel.

EXPANSION JOINTS: (Sec. 10) Expansion joints, when called for on the Drawings shall have integral duck and rubber flanges, with individual solid steel ring reinforcement and a carcass of highest grade woven cotton or acceptable synthetic fiber. Joints shall be pipe line size, and meet

working pressures, conditions and face to face measurements as designated. They shall be of an arch-type construction with the number of arches (corrugations) dependent on projected movement. Expansion joints shall be designed for the appropriate temperatures. Furnish split back-up (or retaining) rings. Furnish control units when movements are projected over and above allowables for the joint. all joints shall be finish-coated with Hypalon paint to prevent ozone attack.

The joints shall be Style 500 (pressure) or Style 700 (vacuum or vacuum-pressure) manufactured by Mercer Rubber Co., Trenton, NJ, 204 or 206 by Garlock Packing Co., Palmyra, NY, or 4140 or 4150 by U.S. Rubber Co., or equal.

DRILLING AND TAPPING: (Sec. 11) Drill and tap pipe and fittings to provide for drainage plugs, house service lines, air vents, or any other piping as required. Drill all holes accurately at right angles to the axis of any pipe, fitting, or face of plugs.

Whenever the wall thickness of the pipe or fitting to be tapped is such that it will not permit enough threads equal to, or greater than, the normal engagement of American Standard Pipe Threads, furnish and install a piece of pipe or a fitting with cast-in-place boss suitable for drilling and taping or a cast iron tapped saddle. Include payment for saddle and installation (if required) in the unit price for the pipe.

PIPE BUILT IN MASONRY: (Sec. 12) Where shown on the Drawings, or where necessary, support the pipe and fittings by masonry. Wherever openings in concrete are left during construction and pipes grouted in place, provide a keyway in the concrete and use a non-shrinking grout.

PAINTING: (Sec. 13) All field painting of pipe and fittings (if required), except as specifically provided in this Item, shall be performed and paid for in Item 3600, Painting.

MARKING: (Sec. 14) Mark all pipe and fittings in accordance with the applicable AWWA standard. Paint an identification number on each piece to agree with a Bill of Material and layout drawing furnished to the Resident Representative prior to the start of the pipe installation. The Contractor shall also keep a copy of the Bill of Material and layout drawing in his field office.

SHOP DRAWINGS: (Sec. 15) Furnish the following to the Engineer for approval:

1. Class of pipe.
2. Pipe material specification.
3. Details of all flexible connections.
4. Location of all flexible connections not shown on the Drawings.
5. Details and specification for all joint accessories.
6. Any deviations from the Drawings and the reason for the deviation.

TESTING: (Sec. 16) Shop test each piece of pipe by hydrostatic pressure before shipment from the factory. Submit the manufactures certificate in duplicate stating that all pipe meets the requirements of these Specifications.

After the complete line, or a reasonable portion thereof, has been installed, test in accordance with Item 1600, Testing Pipe Lines and Sewers. Backfill buried lines before testing.

Make necessary repairs or replacements and retest the line until the requirements for tightness are

net and the installation is satisfactory to the Resident Representative.

STERILIZATION: (Sec. 17) After completion of the installation of potable water lines, flush and disinfect in accordance with Item 1700, Sterilization of Potable Water Lines and Tanks.

CLEAN-UP: (Sec. 18) This Item, 1000, shall include surface clean up immediately following backfilling, removal of all surplus excavation, pipe broken concrete, stones, and all miscellaneous debris. Rough grade to provide drainage.

PAYMENT: (Sec.19)

Lineal Feet: The length of cast iron pipe line to be measured for payment shall be the total length of pipe, including fittings, bends, tees, crosses and required appurtenances, etc., actually placed in accordance with the Drawings, Specifications, or as required, and measured along the centerline of the pipes.

Where existing pipe is cut and fittings or valves are installed in the existing pipe for connecting to a new main, the laying length of the new pipe, fittings and valves installed in the existing line shall be included in the length measured for payment, except where specifically included under other Items of the Specifications. Payment for pipe or fittings included in other Items, such as bridges and highway crossings, special crossings, or system connections, shall be included for payment in their respective Items.

Weight: Include for payment in this Item, the number of tons actually placed in accordance with the Drawings, Specifications, or as required. Weight of individual pieces shall be taken from suppliers' shipping lists or invoices, except as limited below. Do not include weights of bolts, nuts, gaskets, follower rings, glands, lead, oakum, paint and other joint accessories.

Flanged Cast Iron Fittings: Include for payment in this Item the weight of flanged fittings actually furnished and placed in accordance with the Drawings, and Specifications, as required.

Cast Iron Wall Castings: Include for payment in this Item the total weight of wall castings, as defined herein, actually installed in the finished work in accordance with the Drawings.

The total weight of the various categories of ductile or cast iron pipe, fittings etc., shall not exceed the sum of standard, weights by the following percentages:

Bell and spigot, mechanical joint or push-on pipe	2%
Bell and spigot, mechanical joint or push-on fittings	10%
Flanged pipe	5%
Flanged pipe fittings	10%
Wall casting	12%

Standard weights shall be those given in the Handbook, Ductile Iron Pipe, Cast Iron Pipe published by the Ductile Iron Pipe Research Association.